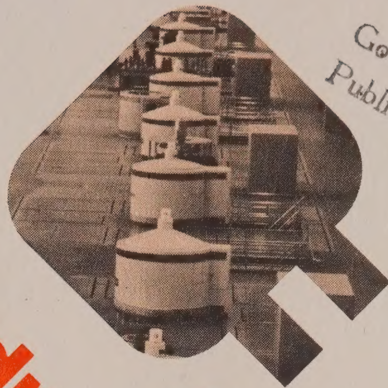
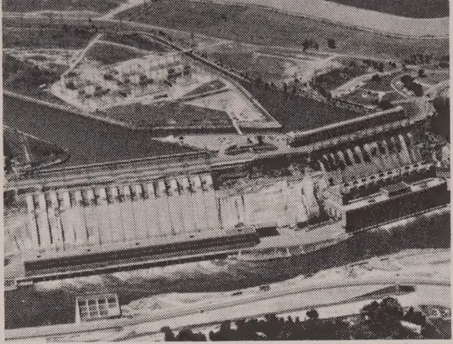
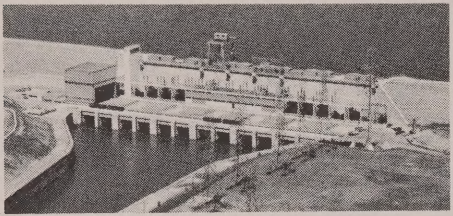
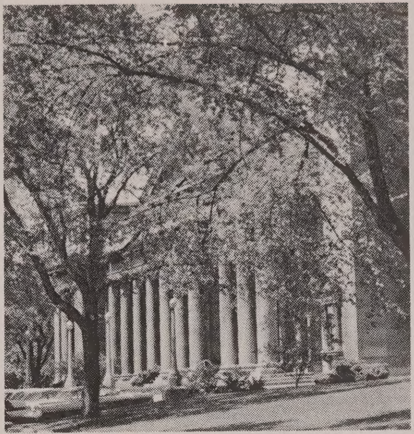
ontario hydro



power from niagara

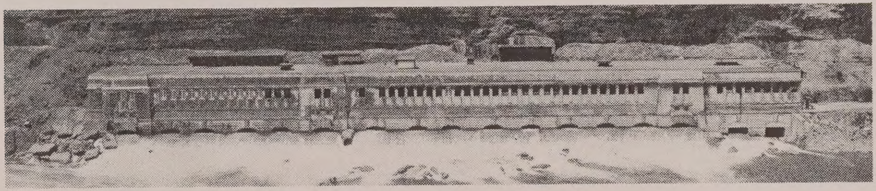


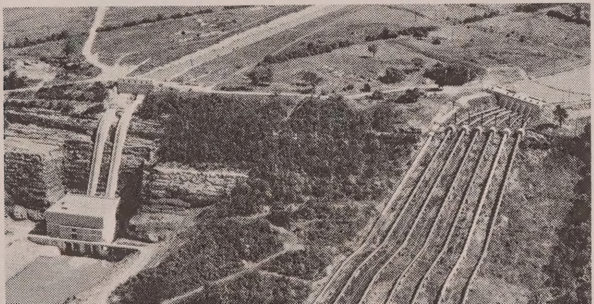




power from niagara

harnessing one of the world's mightiest rivers





he Horseshoe Falls,
n 1852 print made by Salathé
f an original painting by Sebron

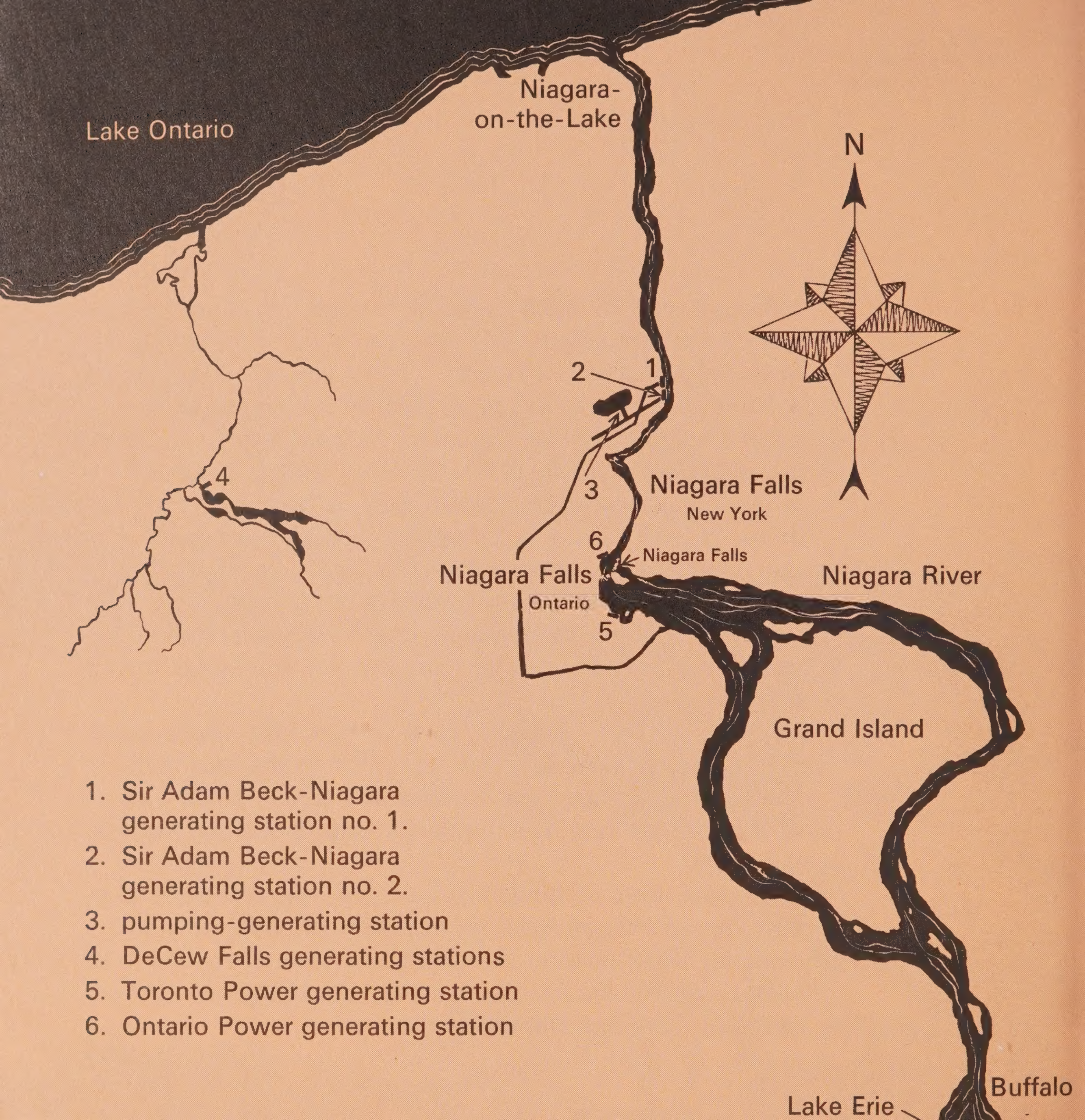
the Niagara river

Although only 35 miles long, the Niagara River is one of the world's greatest sources of hydro-electric power. The beauty of its wild descent from Lake Erie to Lake Ontario attracts millions of visitors each year. During its short course, the river drops a total of 326 feet, with much of this spectacular plunge concentrated in an eight-mile stretch of falls and rapids.

In geological terms the Niagara River is comparatively new. Some 200,000 years ago, massive glaciers lay heavily over the entire area now occupied by the Great Lakes, and it was not until 35,000 years ago that the lakes themselves were formed by melting ice. It was another 10,000 years before the ice gave way at the Niagara escarpment and water roared over the falls.

At this stage in its history, the river bore little resemblance to the Niagara of today. It is thought that the falls emptied almost directly into Lake Ontario and only a small portion of the present vast flow found its way to the sea through this route.

The upper lakes continued to drain into the Atlantic Ocean through the Ottawa River for hundreds of years. Finally, the receding water level in the upper lakes forced the water to seek a path into the Erie basin through the outlets now known as the St. Clair and Detroit rivers.


Lake Ontario
Niagara-
on-the-Lake
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2
1
3
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Niagara Falls
New York
6
Niagara Falls
Niagara Falls
Ontario
Niagara River
5
Grand Island
1. Sir Adam Beck-Niagara generating station no. 1.
2. Sir Adam Beck-Niagara generating station no. 2.
3. pumping-generating station
4. DeCew Falls generating stations
5. Toronto Power generating station
6. Ontario Power generating station
Buffalo
Lake Erie

The upper reaches of the Niagara River are broad and quiet, with a drop of only 10 feet in the first 20 miles. The velocity increases as the river narrows and breaks into rapids about one mile above the brink of the great cataracts, falling about 50 feet in this distance. At the head of the upper rapids the river is split into two channels by Goat Island, with the greater flow taking the channel to the Horseshoe Falls. They have a crest length of 2,100 feet and a drop of 176 feet. The American Falls are 1,100 feet wide and 184 feet high.

After this breathtaking drop, the river resumes its headlong dash to Lake Ontario at the Whirlpool Rapids, about two miles from the foot of the falls. These rapids tumble 50 feet in one mile. From here to the lake, the fall is 40 feet.

As far as electric power production is concerned, the value of a river depends upon the size and uniformity of its flow, the extent and concentration of its descent, and the proximity of markets. The Niagara combines these factors as favorably as any river in the world. Its average flow is slightly over 200,000 cubic feet of water a second; 97 per cent of its drop is concentrated in an eight-mile section, its maximum flow is only 2.9 times its minimum flow, and it is located close to densely-populated and highly-industrialized areas in both the United States and Canada.

Sir Adam Beck, Hydro's first chairman, and H. G. Acres, hydraulic engineer

By comparison, the Columbia and Peace rivers in British Columbia have an average flow about half that of Niagara, and, in their unregulated state, were far less reliable.

The manner in which Ontario has exploited the power potential of this great natural heritage, while preserving and enhancing its unrivalled beauty, is the subject of this booklet.

power from Niagara

Water was first diverted from the Canadian side of the Niagara River for the generation of electric power in 1893. A small, 2,200-kilowatt plant was built just above the Horseshoe Falls and its output used to operate an electric railway between the historic communities of Queenston and Chippawa.

While it does not make use of Niagara River water, it is interesting to note that the DeCew plant at Power Glen, about four miles from St. Catharines, was built in 1898 and is still in operation. This plant is thought to be the oldest major hydro-electric plant in regular service in Canada. It diverts water from the Welland Ship Canal.

The earliest phase of Niagara River power development was carried out by private enterprise and three large generating stations were built almost simultaneously on the Canadian side of the river shortly after the turn of the century. They were the Ontario Power Company (132,500 kilowatts); the Electrical Development Company, later known as Toronto Power


the first power plant—1893

(91,800 kilowatts), and the Canadian Niagara Power Company (94,700 kilowatts).

Ontario was then on the threshold of tremendous expansion. Because it was without abundant resources of basic fuel—at that time coal—hydro-electric power promised an attractive alternative. Fortunately, men of foresight stepped into the picture. On the theory that the water resources of the province rightfully belonged to its people, and that public ownership could be successfully applied to the transmission of electricity from Niagara, they presented various plans to the provincial government providing for the delivery of electricity at cost to participating municipalities.

Their efforts were rewarded in 1906 when The Hydro-Electric Power Commission of Ontario was formed by Act of Legislature. Familiarly known as Ontario Hydro, this commission now supplies about 90 per cent of the electricity used in the province. It owns and operates generating stations on most of the great rivers of Ontario and its transmission

lines extend virtually to all settled areas of the province. Low-cost electricity is supplied directly to rural customers and to certain large industries, while hundreds of towns and cities buy power in bulk from Ontario Hydro and maintain their own distribution systems.

First power was delivered by Ontario Hydro in 1910 and in the early years most of it was bought from the private companies which had established plants on the Niagara. But the rise in demand for electric power was so rapid that by 1913 the Commission was forced to develop its own generating stations. The first was the 750-kilowatt Wasdell Falls generating station on the Severn River.

Ontario Hydro was also investigating other potential hydroelectric sites and, after exhaustive studies of the Niagara River and surrounding terrain, engineers advanced a plan to make maximum possible use of the difference in elevation between lakes Erie and Ontario.

Beck 1 takes shape (top,
the completed plan

Sir Adam Beck-Niagara g.s. no. 1

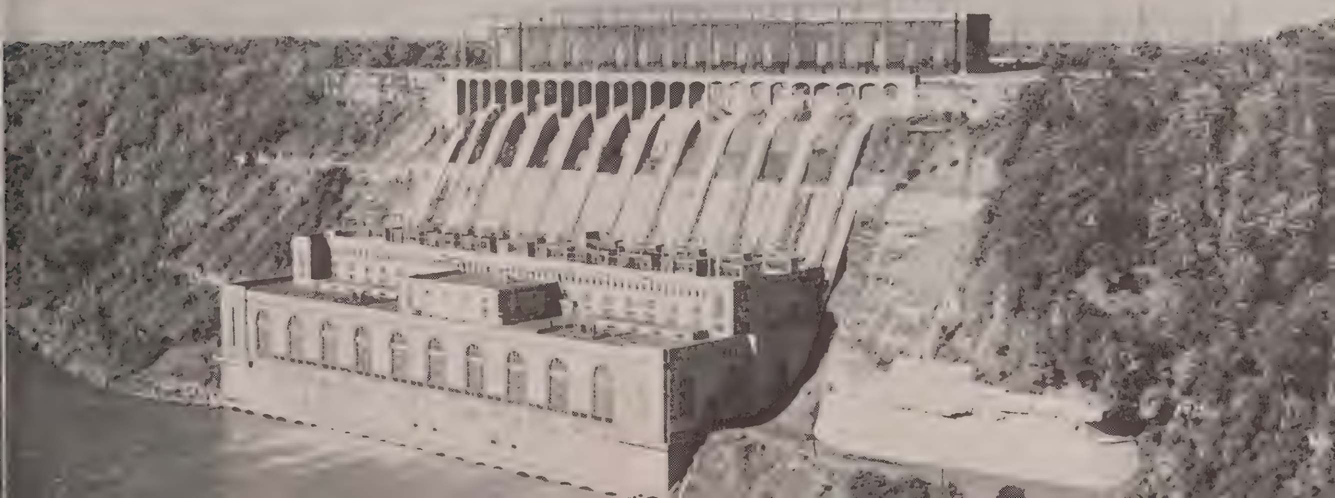
Construction began in 1917 on what for some years would be the largest hydro-electric plant in the world.

Known originally as the Queenston-Chippawa development, and later renamed the Sir Adam Beck-Niagara Generating Station No. 1, in honor of the Commission's first chairman, who has often been called the father of hydro-electric power in Ontario, this project far exceeded all previous developments in scope and execution. By locating their plants near the falls, earlier builders did not take advantage of a further drop of 90 feet in the river between the foot of the falls and the village of Queenston. To utilize the maximum fall, Ontario Hydro's engineers decided to divert water from the river two miles above the Canadian Falls and use it to drive turbines in a plant eight miles downstream.

This scheme involved the development of a water-way with an over-all length of 12½ miles, skirting the city of Niagara Falls from a point two miles above the Horseshoe Falls to a plant on the lower Niagara River about one mile south of Queenston. An 8½-mile canal was excavated and used along with the four miles of the Welland River.

Intake structures

Structures were built above the falls at Chippawa to divert the water. They consisted of a concrete barrier with 15 surface openings, each 18 feet wide, together with six submerged



openings designed for protection against adverse ice conditions.

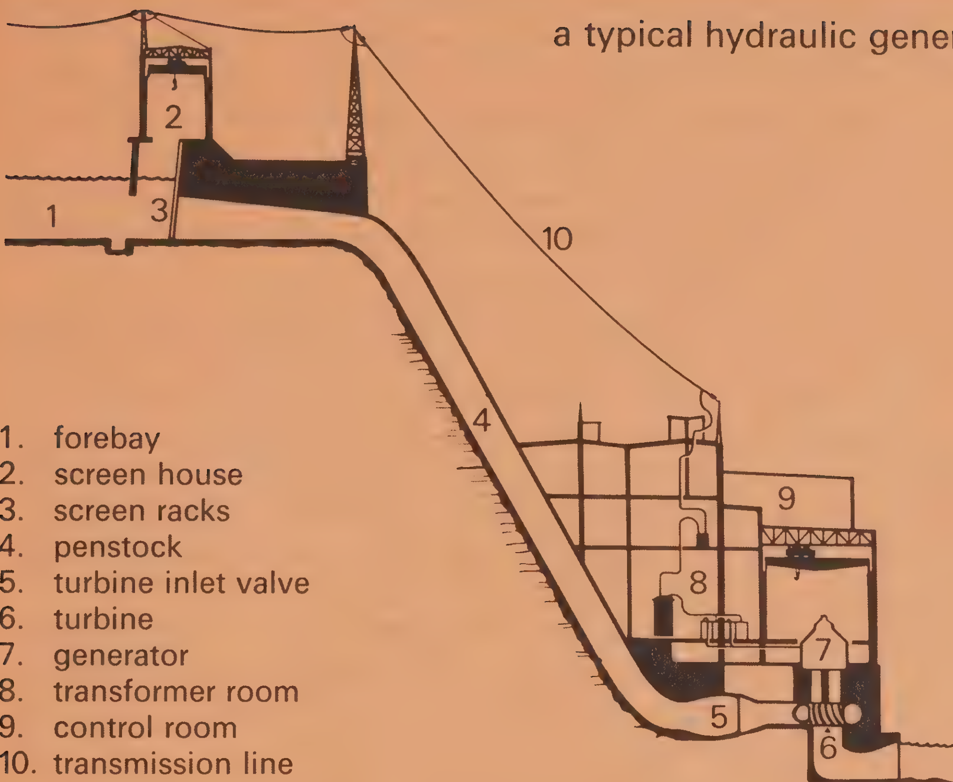
power canal The intake structures were built at the mouth of the Welland River, which joins the Niagara at the village of Chippawa. By dredging and straightening the Welland for four miles upstream, it was possible to reverse the flow in this section and use it for the first part of the power canal. The remaining 8½ miles were excavated in earth and rock to a depth of up to 143 feet. The rock-cut section was lined with concrete below the water level to reduce friction and increase capacity. This canal served its purpose well for 43 years before being rehabilitated in 1964 and 1965.

forebay and penstocks The canal ends in a triangular basin, called a forebay, on the escarpment more than 300 feet above the Niagara River. Water is taken from the forebay, through a screen-house, and conveyed by penstocks down the sheer face of the cliff to the powerhouse on the river's edge.

The screen-house forms a dam at the end of the forebay and contains the entrances to the penstocks, drop gates for closing the penstocks, and racks for screening debris. The entrance to each penstock is a modified bellmouth, divided into three openings which converge to form a single opening 16 feet in diameter.

powerhouse The powerhouse accommodating the generating, transforming, and control equipment rises more than half way up the cliff to a height of 180 feet above foundation. It is 590 feet long. The substructure is of massive concrete carried down to rock foundation. The superstructure is of steel frame and concrete construction with reinforced concrete floors and roof. Nine generating units were brought into service at the Sir Adam Beck No. 1 plant between 1922 and 1925. A tenth was added in 1930. At the time they were installed, these units were the largest ever made. The plant has a capacity of 403,900 kilowatts and an average operating head of 295 feet.

a typical hydraulic generating station



1. forebay
2. screen house
3. screen racks
4. penstock
5. turbine inlet valve
6. turbine
7. generator
8. transformer room
9. control room
10. transmission line

diversion treaties

Water used for power production does not pass over the Falls. If water were to be diverted in sufficient quantity, their beauty could be seriously affected and limitations were set in the early days of Niagara power development. Under the Boundary Waters Treaty of 1909 between Britain and the United States, the daily aggregate of water diverted for power was not to exceed 56,000 cubic feet a second. This quantity was almost entirely accounted for by the early private developments and the first Beck plant.

After careful study, an agreement was signed between Canada and the United States in 1950, which increased the amount of water available for power production. The new agreement, known as the Niagara Diversion Treaty, provides for protection of scenic values. It specifies that the flow over the falls shall not be less than 100,000 cubic feet a second during the daylight hours of the tourist season, or less than 50,000 cubic feet a second at any other time.

A few weeks after this treaty was ratified, Ontario Hydro's construction forces started work on a project more than three times the size of the earlier Beck development.

Sir Adam Beck-Niagara g.s. no. 2

The second development adheres to the same fundamental plan as the first in that they both utilize as much as possible of the available river drop. The plants have approximately the same operating head, they are located side-by-side on the river bank near Queenston, and their intakes are within a few hundred yards of each other upstream from the Canadian Falls. But the area had developed extensively since the first plant was built, and it was not feasible to interrupt surface traffic with the construction of another, and larger, open power canal. After a careful analysis of cost, it was decided that tunnels would be substituted, providing a route almost five miles shorter than the canal.

intakes and tunnels

Twin intakes for the two tunnels consist of concrete structures 500 feet long, parallel to the river bank. Water enters the gathering tubes through slots in the vertical face designed to permit uniform flow under all river conditions. The tops of the slots are below normal river level as a precaution against ice. Control gates for the tunnels are installed immediately downstream.

The parallel tunnels are each 5½ miles long and have a finished diameter of 45 feet. They are lined with concrete and were constructed to a maximum depth of 330 feet, passing directly under the city of Niagara Falls for much of their

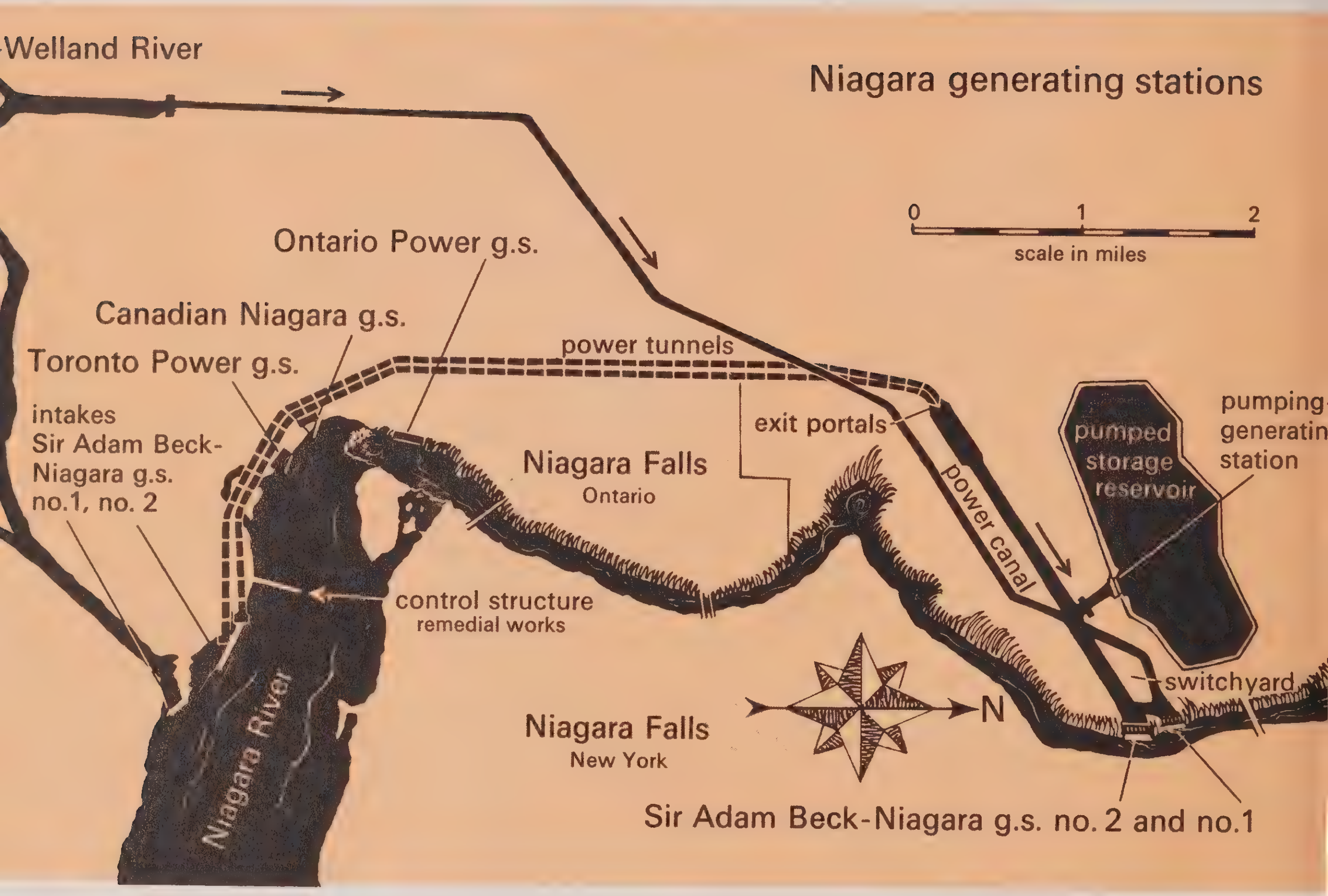
length. Each was designed to carry 20,000 cubic feet of water a second. Together, their construction involved the excavation of 4,335,000 cubic yards of rock and the placing of more than 1,250,000 cubic yards of concrete.

canal and forebay

The tunnels reach maximum depth within the first half mile and rise gradually from this point to converge at the outlet portals which discharge into an open canal leading to the forebay. This canal varies in width between 185 feet and 280 feet, large enough to carry an ocean-going liner, and its 2¼ mile course is through open country.

As the canal approaches the forebay it crosses the old canal leading to the No. 1 plant. By bringing both flows together at a similar velocity, and offsetting the new canal at the intersection, the cross-over is effected without energy loss and the two powerhouses make co-operative use of the diverted water.

The headworks structure of the No. 2 plant is 875 feet long and stretches across the width of the forebay at the downstream end. There are two openings for each of the 16 penstocks and the headgates, stop-log emergency gates, and trash racks are located there. Flow through the penstocks can be shut off by remote control from the powerhouse in an emergency.



Welland River
Niagara generating stations
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scale in miles
Ontario Power g.s.
Canadian Niagara g.s.
Toronto Power g.s.
power tunnels
intakes
Sir Adam Beck-
Niagara g.s.
no.1, no. 2
exit portals
Niagara Falls
Ontario
power canal
pumped
storage
reservoir
pumping-
generatin
station
control structure
remedial works
Niagara River
switchyard
N
Niagara Falls
New York
Sir Adam Beck-Niagara g.s. no. 2 and no.1

penstocks Erection of the penstocks at the No. 2 plant was a major accomplishment in itself. These giant steel tubes are 19 feet in diameter and 500 feet long. They were installed in shallow trenches cut in the face of the cliff on a slope of 60 degrees from the horizontal for most of their length. Each penstock was built of 68 prefabricated rings which were lowered into position individually, welded, and then encased in two feet of concrete.

A great deal of loose rock had to be scaled from the cliff face before work could begin on the precipitous surface. This material was placed along the shoreline in front of the powerhouse site to form a cofferdam 35 feet wide. By such means, it was possible to work at the lower levels "in the dry." This rock barrier was later removed by blasting and dredging.

powerhouse Standing side-by-side in their spectacular setting, the two generating stations reflect the progress in design, construction and engineering since the first plant was brought into service in 1922. The later building is an impressive structure with clean, functional lines. No. 2 plant houses 16 generating units compared with 10 in the No. 1 plant, and it is almost twice as long.

Power is generated at 13,800 volts, and is stepped up to 230,000 volts by the main transformers, located on a deck

the Beck stations
with the newer plant at lef

immediately behind the powerhouse superstructure. The high-voltage circuits from the transformers are carried on steel towers and girders over the top of the escarpment to a switchyard on the island between the forebays of the two stations. Outgoing lines feed into the Ontario Hydro system, which serves Ontario and is interconnected with utilities in Quebec, Manitoba, New York, and Michigan. The Sir Adam Beck No. 2 plant, together with a pumping-generating station, has an installed capacity of 1,400,300 kilowatts, much greater than the Robert H. Saunders—St. Lawrence Generating Station's capacity of 912,000. The combined capacity of all Ontario Hydro's Niagara River plants is almost 2,000,000 kilowatts, more than the entire St. Lawrence power development's 1,800,000 kilowatts.

pumping-generating station

The scheme involving the storage of vast quantities of water for use during periods of peak power demand contributes substantially to the peak output of the Sir Adam Beck plants. Basically, it consists of a reversible-flow canal which connects into the existing power canal system, a pumping-generating station, and a man-made reservoir.

During the hours when the demand for power is lowest, the six reversible units at the pumping-generating station are used as pumps to fill the reservoir. This great basin, almost 750

acres in extent and with a capacity of 650,000,000 cubic feet, is contained by massive rock-fill dykes lined with an impervious clay blanket. Water is released during the periods of high demand and, on this cycle, the same units act as generators. This reverse flow also provides additional water when it is needed most at the Beck plants further downstream. The pumping-generating station is operated automatically from the No. 2 plant. The increased capacity made possible by the pumped-storage development is more economic than developing power from a coal-burning thermal-electric station. The Sir Adam Beck No. 2 plant was officially opened by the Duchess of Kent in August, 1954. Seven generating units were brought into service that year and five others in 1955. The final four units, together with the six installed at the pumping-generating station, were placed in operation during 1957 and 1958.

DeCew falls g.s.

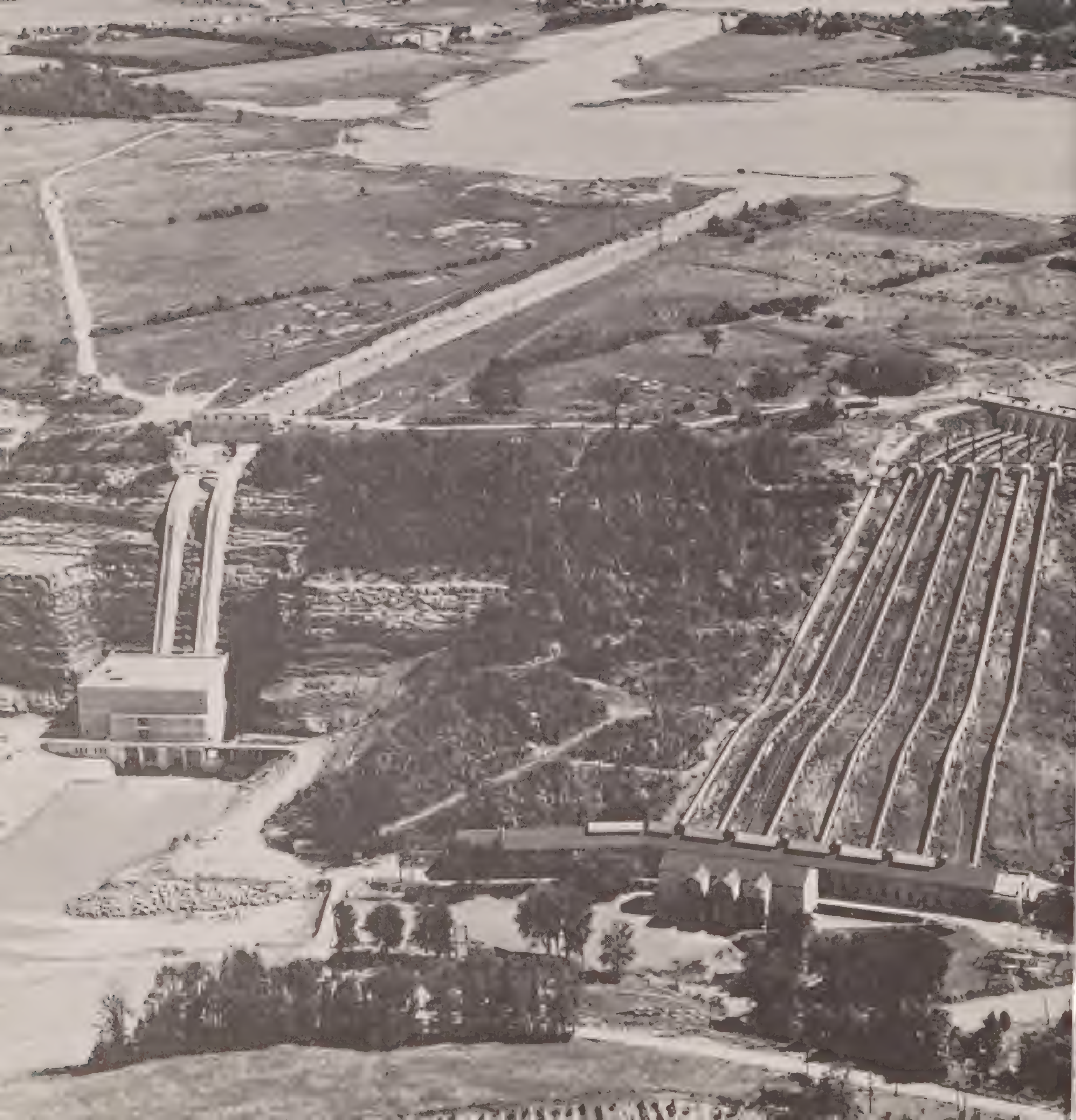
In the interval between the construction of the two Sir Adam Beck plants, Ontario Hydro built a second DeCew plant at "Power Glen." It was brought into service in 1943 and a second unit was added in 1947.

The first plant, mentioned earlier, was built by the Dominion Power and Transmission Company in 1898 and was acquired by the commission in 1930.

Both DeCew plants make use of Lake Erie water drawn from the Welland Ship Canal through intakes near Allanburg. Lake Gibson acts as a natural reservoir, or headpond, from which the water is conveyed through penstocks down the Niagara escarpment to the plants below. Water is discharged into Twelve Mile Creek, which empties into Lake Ontario.

By this means, the DeCew plants utilize almost as much of the drop between lakes Erie and Ontario as do the Sir Adam Beck installations, but much less water is available at this site. Their total capacity amounts to about 150,000 kilowatts.

Construction of the newer DeCew plant involved excavation of a canal 2,100 feet long from Lake Gibson to the edge of the escarpment. Considerable earth and rock excavation was also required in the headpond area, at the powerhouse site, and in the trailrace and creek channel. This project was carried out in a highly-developed area which gave rise to many problems



involving the protection of private property, the building or rebuilding of bridges and roads, and the relocation of underground and overhead utility equipment.

The new DeCew plant was made possible by an ingenious water diversion project carried out by Ontario Hydro many hundreds of miles to the northwest.

Through an agreement with the United States, permission was granted to use additional Lake Erie water equal to that introduced through the Long Lake and Ogoki River diversions. The flow of these two bodies of water was reversed from Hudson Bay to Lake Superior by a system of dams and channels across the height of land dividing the two watersheds. This extra flow, which averages 5,000 cubic feet a second, influences the output of hydro-electric stations as far apart as the Nipigon, Niagara and St. Lawrence Rivers. It also benefits navigation.

Ontario Power g.s.

This generating station was brought into service by the Ontario Power Company in 1905 and has figured prominently in the history of Ontario Hydro since 1910 when first power was purchased for distribution to the original participating municipalities. The plant itself was acquired by Ontario Hydro in 1917.

Located almost at river level near the foot of the Horseshoe Falls, the Ontario Power plant draws its water from an intake about half a mile above the crest of the falls. Water is conveyed to the turbines through a system of conduits and steel penstocks tunnelled through the solid rock of the escarpment. The plant utilizes a vertical drop of 180 feet, and has 12 generating units with a combined capacity of 101,500 kilowatts. Access to the powerhouse is obtained by means of an elevator and tunnel from the entrance building in Queen Victoria Park. The various structures associated with this development are prominent features of the Niagara Falls setting, and even at the early date they were built, the preservation of natural beauty was a primary consideration. They have been skilfully designed to harmonize with their surroundings and it is estimated that the Ontario Power Company spent more than a million dollars solely to preserve the aesthetic values of this spectacular area.

Toronto Power g.s.

A second plant was brought into service by private enterprise one year after the Ontario Power Company station began operation. Known as the Toronto Power station, it was bought by Ontario Hydro in 1922. It had 11 units with a combined capacity of 91,800 kilowatts until 1969, when six units were removed from service leaving five in operation with a capacity of 39,600 kilowatts.

Unlike its contemporary, this plant is located about 400 yards upstream from the Horseshoe Falls. It has an operating head of 137 feet, which was obtained by an unusual arrangement. The plant has a short intake and the water is discharged into steel penstocks set in vertical tunnels bored through the rock directly beneath the powerhouse floor. The turbines are located in a wheel-pit at the bottom of the penstocks and are coupled to the generators on the operating floor of the powerhouse by long steel shafts supported by several flying arches. Water is discharged through a tunnel which has its outlet under the river behind the Horseshoe Falls.

Although their use has declined in recent years, both these plants have operated for more than half a century—a fact testifying to the courage and ability of the men who planned and built them.

remedial works

Erosion by the relentless surge of water cascading over Niagara Falls has been virtually halted by a $12,500,000 remedial works program carried out by Ontario Hydro and the Corps of Engineers, United States Army. The insidious erosion caused the crest of the Horseshoe Falls to recede more than 856 feet since records were first kept in 1764 and threatened to destroy their spectacular beauty.

Provision for the remedial works was made in the Niagara Diversion Treaty of 1950 and they were implemented between 1954 and 1957 after a careful study of requirements. Improvements included extensive filling, excavation, and landscaping on both flanks of the Horseshoe Falls at the crest, and the construction of a 13-gate control structure above the falls. A five-gate extension to the structure and the removal of a shoal at Tower Island were completed in 1963.

The river bed excavations divert water from the deep centre channel of the river above the falls and distribute it more evenly along the crest. This not only enhances the scenic effect by producing an unbroken crestline, but reduces the rate of erosion in the notch near the middle of the river at the falls. The earth and rock fills also contribute towards the unbroken crestline by eliminating incidental flows at both flanks. The filled areas were utilized as lookout sites.

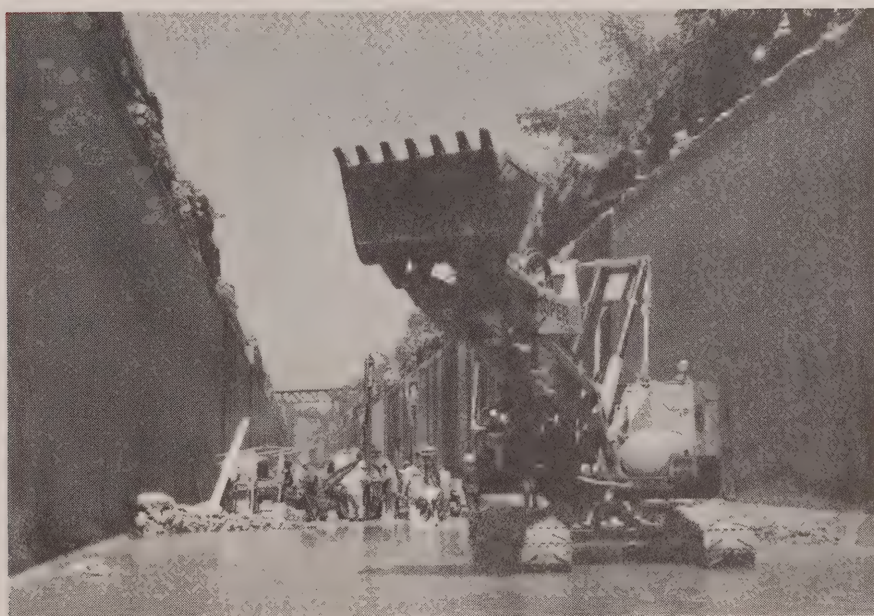

control structure
excavation
excavation
fill

Both power and beauty are served by the graceful control structure, which extends about one third of the way across the river from a point on the Canadian side one mile upstream from the falls. This structure permits closer control of the Chippawa-Grass Island Pool and regulates water flowing over the Horseshoe Falls according to the provisions of the Niagara Diversion Treaty. It also assures that the flow over the American Falls is adequate at all times. The five-gate extension was built to maintain water levels with the increased diversion of water from the Grass Island Pool for the Power Authority of the State of New York's new Robert Moses Niagara Power Plant, opposite Hydro's Beck stations.

Studies preceding the remedial scheme were helped by the use of an elaborate hydraulic model built by Ontario Hydro. The model depicted five miles of the river, from the tip of Grand Island to Rainbow Bridge below the cataracts, and it measured 95 feet by 37 feet. Its size permitted engineers to simulate conditions of the river with great accuracy, including minute variations of river flow and contours of the river bed. Hydraulic models were also used to great advantage during the construction of the Sir Adam Beck-Niagara No. 2 plant. Their use is estimated to have saved about $5,000,000.

anal rehabilitation

In 1964, the Chippawa power canal was closed for deepening, widening and general repairs. It was reopened in the winter to meet peak demands for power and closed again in 1965 for completion of the work. The two-year face-lifting increased water flows by 6,500 cubic feet a second, boosting output of the Beck stations 11 per cent.



ice boom A two-mile ice boom was first installed across the eastern end of Lake Erie in 1964 by Ontario Hydro and the Power Authority of the State of New York. The boom helps to stabilize Lake Erie's ice sheet, reducing the risk of ice drifting down the Niagara River to block power station intakes and damage shoreline structures.

It consists of a series of floating timbers, each 30 feet in length and spanning the lake in 22 shallow arches. These are attached by chains to an underwater steel cable firmly anchored to the lake bed. If strong westerly winds force large masses of ice against the boom, the timbers will sink under the pressure allowing excess ice to flow past. When the wind subsides, the boom surfaces again and cuts off the movement of ice from the lake. The boom is installed after the close of the Great Lakes shipping season and is dismantled and stored on shore once the freeze-up ends.

points of interest The Niagara district undoubtedly ranks among the top tourist attractions in North America and the cataracts themselves will always remain foremost among its many points of interest. Their beauty has been preserved and enhanced by the remedial works program and they are dramatized each evening by a 4,200,000,000-candlepower bank of lights which provides a panoramic, multi-colored view of the entire falls area.

the cascades Every conceivable vantage point has been utilized so that the millions of visitors who come to Niagara each year may see the falls in true perspective. An observation platform has been built near the base of famed Table Rock, offering visitors a spectacular view of the Horseshoe Falls towering overhead. From this point, a subterranean passage has been cut into the escarpment so that it is possible to view the cataracts even from behind the great curtain of water.

An equally inspiring view may be had from the decks of the two Maid of the Mist vessels plying through the swirling waters at the foot of the falls. Flying spray and mist make oilskins obligatory on these excursions.

the rapids The river begins its turbulent descent a mile above the falls and access to this picturesque section is provided by scenic paths and drives. A mile or so below the cataracts, the upper gorge narrows considerably and at one point the drainage

waters of some 255,000 square miles of the North American continent roar through a channel only 300 feet wide.

An elevator operates between Whirlpool House and the base of the gorge at this point, and observation platforms and a boardwalk have been built at the very edge of the torrent. The Whirlpool swirls ceaselessly at the foot of these rapids and the more adventurous can witness its action from a cable car which swings from shore to shore, high above the river.

parks system

Visitors from all over the world have marvelled at the Niagara parks system which is maintained by the Ontario government. Encompassing more than 3,000 acres, the parks extend 35 miles along the length of the Niagara River from Lake Erie to Lake Ontario.

Featuring floral and shrubbery displays, rock gardens, lily ponds, terraces and fountains, they combine the great natural beauty of the area with man's skill in the arts of horticulture, floriculture and landscaping. These, and allied subjects, are taught in the Niagara Parks School of Gardening, which offers the only three-year course of its kind in North America. The parks system is itself tribute to the graduates of this school, many of whom have worked for the Niagara Parks Commission. An innovation by the Parks Commission is the installation of landscape illumination. Hundreds of lighting

oral clock

units in trees and shrubbery provide "moonlight" 365 nights of the year. Over the years, Ontario Hydro's payments of millions of dollars for the use of Niagara River water have greatly assisted the Parks Commission.

floral clock

The unusual floral arrangement at Niagara Falls was executed by Ontario Hydro's Niagara Region staff, who designed and built a floral clock, with a dial composed of nearly 24,000 carpet plants. Its design was inspired by the original floral clock in Edinburgh, but the Hydro clock is more than three times larger than its Scottish counterpart.

Situated six miles from the falls, at the Sir Adam Beck-Niagara generating stations, this outdoor timepiece has an over-all diameter of 40 feet. Its hour and minute hands each weigh 500 pounds, while the sweep second hand weighs 250 pounds and is 21 feet long. Chimes are broadcast from a stone tower at the back of the clock, on the quarter hour. An illuminated water garden curves gracefully around its base.

ydro hall of memory

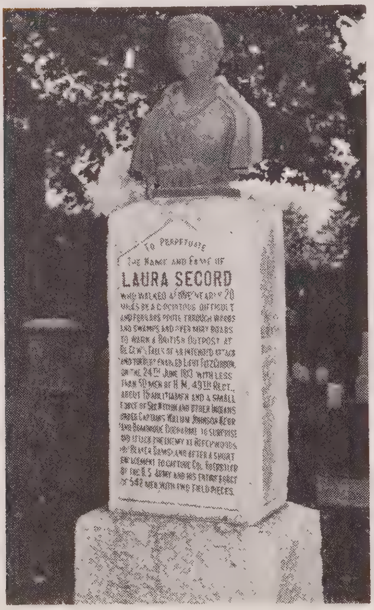
Opened in Canada's centennial year, the Hydro Hall of Memory is an added attraction for the thousands who visit the Queenston power stations. The display, in the foyer of the Sir Adam Beck Generating Station No. 1, outlines the history of electricity in Ontario, with particular emphasis on the role of the municipalities.

Brock monument, Queenst

Visitors can read about the exploits of Hydro pioneers and see pictures, maps, statistics and early electrical equipment. Memorial plaques bear the names of those prominent in the development of the province's power network.

historic sites

Students of Canadian history will find Niagara a fertile ground to explore. This was one of the main portages used by the Indians in their journeys up and down the great inland waterway that reaches from Manitoba to the Atlantic Ocean.



Laura Secord memorial, Drummond Hill cemetery

Many of the battles of the War of 1812 between Canada and the United States were fought in the area. This is the land of Lundy's Lane and Queenston Heights, where Sir Isaac Brock and Laura Secord played their heroic roles in shaping Canada's destiny. Among its many historic sites are Fort George, Fort Erie, Butler's Burial Ground, Navy Island, Chippawa Village, Mackenzie House, Drummond Hill Cemetery and Niagara-on-the-Lake.

other attractions Fine restaurants overlook the falls: in picturesque Niagara Glen and on Queenston Heights, 340 feet above the river. Picnic grounds, souvenir shops, golf courses, and miles of wooded paths, shady dells, and quiet pools all contribute to the magic of Niagara in the spring, summer and fall.

The rich fruit lands of Southern Ontario provide the visitor with an extra measure of enjoyment, particularly in blossom-time and when the trees are heavy with ripening fruit.

The Welland Ship Canal is another point of interest in the vicinity. A vital link in the St. Lawrence Seaway system, the canal by-passes the turbulent Niagara River. It overcomes the 326-foot drop between Lake Erie and Lake Ontario by means of eight massive locks.

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